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# MULTIMEDIA UNIVERSITY

## FINAL EXAMINATION

TRIMESTER 1, 2017/2018

**PES0024 – ESSENTIAL STATISTICS**  
( FM31/FM41/FFE31 )

21 OCTOBER 2017  
9.00 a.m - 11.00 a.m  
( 2 Hours )

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### INSTRUCTIONS TO STUDENTS

1. This Question paper consists of 4 pages with 4 Questions only.
2. Attempt **ALL FOUR** questions.
3. Please print all your answers in the Answer Booklet provided.
4. **Formula** is provided at the back of the question paper.
5. **Statistical book** is provided.

**Question 1 (25 marks)**

a. Let the random variable  $X$  represent the number of boys in a family of three children. Assume that the probability of boy is 0.36 and girl is 0.64. By using the probability function  $f(x) = \binom{n}{x} p^x q^{n-x}$ ,

- construct a table describing the probability distribution of  $X$ . (5 marks)
- based on part (i), find the standard deviation of  $X$ . (6 marks)

b. Consider the following probability density function for a continuous random variable  $X$ ,

$$f(x) = \begin{cases} c(2x - x^2) & ; \quad 0 \leq x < 2.5 \\ 0 & ; \quad \text{elsewhere} \end{cases}$$

- Determine the value of  $c$ . (4 marks)
- Find  $P(1.5 < x < 2)$ . (4 marks)
- Compute the standard deviation. (6 marks)

**Question 2 (25 marks)**

a. In a Mathematics test, 5 percent students obtained grade A. Suppose that the total number of students is 10, by using the Binomial formula :  $B(n, p) = \binom{n}{x} p^x q^{n-x}$ , find the probability that

- at most 2 of the students score grade A in that Mathematics test? (4 marks)
- more than 3 students do not score grade A in that Mathematics test? (4 marks)

b. The average salary of waiters in a famous seafood restaurant is RM5 per hour. By using Poisson formula :  $P(X = x) = \frac{\lambda^x e^{-\lambda}}{x!}$ ,

- Find the probability that the waiters receive wages between RM6 and RM 8 per hour. (4 marks)
- Calculate the mean and standard deviation of the hourly wages of the waiters. (3 marks)

c. The marks of English Placement Test are normally distributed with an average of 58 and standard deviation of 10.

- Find the probability that the supplementary exam mark for a student is less than 60 marks. (3 marks)

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ii. Find the probability that the supplementary exam mark for a student is more than 50 marks. (3 marks)

iii. Find the score of the student who obtains a score that is higher than 10% of all the students. (4 marks)

**Question 3 (25 marks)**

a. Given the set of numbers 1, 3, 5, 7 and 9.

- Find the population mean and standard deviation. (3 marks)
- Construct a sampling distribution of the mean (without replacement) for sample of size  $n = 3$ . (8 marks)
- Calculate the sampling error. (4 marks)

b. The heights of pecan trees follow a normal distribution with mean of 180 cm and a standard deviation of 20 cm. A random sample of 10 plants is taken, and the mean height,  $\bar{x}$  is calculated.

- What is the probability that a randomly selected pecan tree is between 160 cm and 200 cm. (5 marks)
- If  $P(\bar{x} > k) = 0.0571$ , find the value of  $k$ . (5 marks)

**Question 4 (25 marks)**

a. The cars speed (mi/h) measured from a selected highway in City A is normally distributed with a standard deviation  $\sigma = 4.08$ . A random sample of 12 cars are given as below:

62	61	61	57	61	54
59	58	59	69	60	67

- What is the point estimate of the population mean (3 marks)
- What is the margin error associated with the point estimate of the population mean. (3 marks)
- Construct a 95% confidence interval for the mean cars speed. (5 marks)

Continued .....

b. An inspection agency is interested in evaluating the actual amount of apple juice that is filled in a 1.5 liter bottle of a juice factory. The manufacturer of the factory has informed the inspection agency that the standard deviation for 1.5-liter bottles is 0.03 liter. A random sample of one hundred 1.5-liter bottles obtained from this factory indicates a sample average of 1.45 liters.

- i. Construct a 97% confidence interval for the mean amount of apple juice that is filled in the 1.5 liter bottles. Express your answer in 3 decimal places. (6 marks)
- ii. State two factors that can affect the width of confidence interval and discuss the best alternative. (3 marks)
- iii. Suppose the inspection agency wants to estimate the mean amount of apple juice for all 1.5 liter bottles at a 99% confidence level. How large a sample should the inspection agency select if they want the estimate to be within 0.01 liter of the population mean? (5 marks)

**End of Page.**

**Formula:**

1.

	Mean	Variance
<b>Discrete Random Variable X</b>	$\mu = E(X) = \sum xP(x)$	$Var(X) = E(X^2) - [E(X)]^2$ where $E(X^2) = \sum x^2 P(x)$
<b>Continuous Random Variable X</b>	$\mu = E(X) = \int_{-\infty}^{\infty} xf(x)dx$	$Var(X) = E(X^2) - [E(X)]^2$ where $E(X^2) = \int_{-\infty}^{\infty} x^2 f(x)dx$

2.

	Formula	Mean	Standard Deviation
<b>Binomial Probability</b>	$P(x) = \binom{n}{x} p^x q^{n-x}$	$\mu = np$	$\sigma = \sqrt{npq}$
<b>Poisson Probability</b>	$P(x) = \frac{e^{-\lambda} \lambda^x}{x!}$	$\mu = \lambda$	$\sigma = \sqrt{\lambda}$

3. The  $z$  value for a value of  $x$ :  $z = \frac{x - \mu}{\sigma}$

4. The  $z$  value for a value of  $\bar{x}$ :  $z = \frac{\bar{x} - \mu_{\bar{x}}}{\sigma_{\bar{x}}}$

where  $\mu_{\bar{x}} = \mu$  and  $\sigma_{\bar{x}} = \frac{\sigma}{\sqrt{n}}$

5. Point estimate of  $\mu = \bar{x}$

Margin of error =  $\pm 1.96\sigma_{\bar{x}} = \pm 1.96 \frac{\sigma}{\sqrt{n}}$  or  $= \pm 1.96s_{\bar{x}} = \pm 1.96 \frac{s}{\sqrt{n}}$

6. The  $(1 - \alpha)100\%$  confidence interval for  $\mu$  is  $\bar{x} \pm z \frac{\sigma}{\sqrt{n}}$

7. Sample variance:  $s^2 = \frac{\sum x^2 - \frac{(\sum x)^2}{n}}{n-1}$